

# Claims

- [c1] 1.A method of inspecting a sample's surface with an inspection system, comprising the steps of:  
providing a sample having a surface;  
providing a non-vibrating contact potential probe;  
scanning the sample's surface with the non-vibrating contact potential probe by causing relative motion between the non-vibrating contact potential probe and the sample's surface;  
measuring contact potential difference between the sample's surface and the non-contact potential probe;  
generating a first signal portion characteristic of a topographical feature of the sample's surface and further having a second signal portion representing chemical features of the sample's surface.
- [c2] 2.The method of inspecting a sample's surface further comprising the step of amplifying the topographical signal relative to the chemical signal.
- [c3] 3.The method of inspecting a sample's surface of Claim 1 further comprising the step of biasing a portion of the inspection system.

- [c4] 4.The method of inspecting a sample's surface of Claim 3 further comprising the steps of:  
providing a negative bias voltage to a portion of the inspection system chosen from the group consisting of the non-vibrating contact potential difference probe, the sample, and combinations thereof;  
providing a positive bias voltage of substantially equal but opposite charge as the negative bias voltage to the portion of the inspection system to which the first bias voltage was applied; and  
subtracting the negative bias signal from the positive bias signal.
- [c5] 5.The method of inspecting a sample's surface of Claim 1, wherein the relative motion is accomplished by rotating the sample about a central axis with the probe tracing tracks of data at varying radii.
- [c6] 6.The method of inspecting a sample's surface of Claim 5, further comprising the step of decreasing rotational velocity in proportion with the motion of the probe to provide the probe with substantially even data density.
- [c7] 7.The method of inspecting a sample's surface of Claim 1 further comprising the step of providing a plurality of non-vibrating contact potential difference probes.

- [c8] 8.The method of inspecting a sample's surface of Claim 8, wherein the plurality of probes are arranged in a linear array.
- [c9] 9.The method of inspecting a sample's surface of Claim 8, wherein the plurality of probes are arranged in a two-dimensional array.
- [c10] 10.The method of inspecting a sample's surface of Claim 8 further comprising the step of providing the plurality of probes at a plurality of heights.
- [c11] 11.The method of inspecting a sample's surface of Claim 8 further comprising the step of providing a voltage bias to the plurality of probes.
- [c12] 12.The method of inspecting a sample's surface of Claim 1, wherein the relative motion is provided by moving the non-contact potential difference probe with respect to the sample which is maintained substantially stationary.
- [c13] 13.The method of inspecting a sample's surface of Claim 1, wherein the relative motion is provided by moving the sample with respect to the non-vibrating contact potential probe which is substantially stationary.
- [c14] 14.The method of inspecting a sample's surface of Claim 1 further including the step of providing a height sensor.

[c15] 15. The method of inspecting a sample's surface of Claim 1, further including the step of calibrating the height of the non-vibrating contact potential difference probe to measurements made by the height sensor.

[c16] 16. The method of inspecting a sample's surface of Claim 1, wherein the step of calibrating the height of the non-vibrating contact potential difference probe to measurements made by the height sensor further comprises the steps of:

positioning the height sensor above a reference surface so that the distance between the reference surface and the height sensor is within a range of detection for the height sensor;

recording the height of the sensors as  $z_1$ ;

recording the height of the height sensor reading above a reference point as  $h_1$ ;

moving the non-vibrating contact potential sensor to a position above the reference point on the reference surface;

slowly moving the non-vibrating contact potential sensor down towards the reference surface while monitoring the level of the non-contact potential difference probe signal; and

recording as  $z_2$  the height when the non-vibrating contact potential difference probe contacts the reference

surface as indicated by a significant change in the output of the non-vibrating contact potential difference probe.

- [c17] 17. The method of inspecting a sample's surface of Claim 16 further comprising the step of positioning the non-vibrating contact potential difference probe at a desired height of  $h^*$  by the steps of:
- positioning the height sensor above the surface so that the surface is within a measurement range of the height sensor;
  - recording this height as  $z_3$  and the height sensor reading as  $h_3$ ;
  - positioning the non-vibrating contact potential probe above the point  $z_3$ ; and
  - adjusting the height to  $z^* = z_3 - (h_3 - h_1) - (z_1 - z_2) + h^*$ , wherein the height of the non-vibrating contact potential difference probe is located above the surface of point  $z_3$  at height  $h^*$ .
- [c18] 18. The method of inspecting a sample's surface of Claim 1, wherein the sample comprises an liquid crystal panel.
- [c19] 19. The method of inspecting a sample's surface of Claim 1, wherein the sample comprises a semiconductor wafer.
- [c20] 20. A system for identifying features on the surface of a sample comprising:

a non-vibrating contact potential difference sensor;  
a mechanism for causing relative motion between the sample and the non-vibrating contact potential difference sensor;  
a mechanism for measuring contact potential difference between the sample and the non-vibrating contact potential probe;  
a generated signal representing the contact potential difference; and  
a generated bias voltage applied to a portion of the system chosen from the group consisting of the sample, the non-vibrating contact potential probe, and combinations thereof.

- [c21] 21. The system for identifying features on the surface of a sample of Claim 20 further comprising a plurality of non-vibrating contact potential probes.
- [c22] 22. The system for identifying features on the surface of a sample of Claim 20 further comprising a height sensor.
- [c23] 23. The system for identifying features on the surface of a sample of Claim 20, further comprising a voltage bias applied to a portion of the system.
- [c24] 24. A system for inspecting the surface of a sample comprising:

a non-vibrating contact potential difference sensor;  
a chuck for rotating the sample about a central axis;  
the chuck having a variable speed control mechanism for  
changing rotational velocity in proportion with the motion of the probe to provide the probe with substantially even data density; and  
a source of data representing a contact potential difference between the non-vibrating contact potential difference sensor and the surface of the sample.